Abstracts

Abstracts

T. ITOH and K. SHIMAJI: **Wood Species of Excavated Pillars used for Ancient Buildings,** Mokuzaikenkyushiryo (Wood Research Review), **14**, 49 (1979) (in Japanese).

Chamaecyparis obtusa had been used as ancient building pillars with 60% among 150 samples and 75% among 85 samples in Heijyo Palace Site (8th cent.) and Mikogaya Relices (8–9th cent.), respectively. It was supported that *Chamaecyparis obtusa* was the most useful wood for ancient palace buildings as described in classics "Nihonshoki".

It is striking that *Sciadopitys verticillata* had been used as building pillars with 36% among 150 samples in Heijo palace site and 13% among 100 samples in Mikogaya Relices.

K. SHIMAJI: **Lecture Characteristics of Wood 2. Histological Structure of Wood,** Zairyo (J. Soc. Mater. Sci. Japan), **28**, 671 (1979) (in Japanese).

Explanations on the growth of tree stems and wood formation, visual and anatomical characteristics of wood, and the variation of anatomical characteristics within a stem were made with emphases on the biological nature of wood as a material.

K. SHIMAJI, T. ITOH and S. HAYASHI: **Wood Species used for Ancient Palaces and Government Buildings,** in Natural Scientific Approaches in Archaeology and Art History (Editional Committee of Kobunkazai ed.) Japan Society for the Promotion of Science, 249–260 (1980) (in Japanese).

Wooden materials excavated from the relics of ancient palaces and government buildings in Fujiwara Palace Site (7th cent.), Heijo Palace Site (8th cent.), Mikogaya Relics (8–9th cent.) and Dazaifu Historic Site (8–10th cent.) were surveyed microscopically for identification.

Among 274 materials, 161 *Chamaecyparis obtusa*, 70 *Sciadopitys verticillata*, 15 *Cryptomeria japonica*, 13 *Podocarpus macrophyllus*, 2 *Abies firma*, 2 *Tsuga sieboldii*, 1 *Taxus cuspidata* and 1 *Pinus* sp. (Diploxylon) of conifers, and 6 *Castanopsis* sp., 2 *Castanea crenata* and 1 *Cyclobalanopsis* sp. of angiosperms were identified.

Some discussions on the relation between these wood species and their ancient utilization were made.

K. YAMAGUCHI, T. ITOH and K. SHIMAJI: **Compression Wood Induced by 1-N-Naphthylphthalamic Acid (NPA), an IAA Transport Inhibitor,** Wood Sci. Technol., **14**, 181 (1980).

NPA, applied in a 2–3 cm band around the middle portion of 2– or 3-year-old internodes of three vertically-oriented six-year-old Sugi trees (*Cryptomeria japonica*

D. Don), brought about abnormal thickening all over the upper segment from the NPA treatment. Xylem tissues above and below the treatment, as well as at the treated area itself, was examined by ordinary light microscopy and by scanning electron microscopy. The results obtained seemed to indicate that the tissue formed after treatment in the upper segment of the stem was true compression wood. In the lower segment of the stem, no abnormal tissue but a small amount of latewood-like tissue was produced after treatment.

Referring to the previous studies in which morphactin, another IAA transport inhibitor, has induced compression wood, we consider it likely that compression wood formation must be induced by high concentrations of endogenous IAA, which could be brought about by blockage created not only by NPA and morphactins, but also by IAA transport inhibitors in general.

S. HAYASHI, K. SHIMAJI and T. ITOH: **Anatomical Identification of Wooden Products Excavated from the Sakai Moat Site,** Sakai City Cultural Property Research Report, **6**, (1), 36 (1980). (in Japanese)

The sakai moat site is located in north-west of Sakai city, and this moat had been constructed in the Muromachi era (the Fifteenth century). The excavated ten wood samples are dried and hardend, and are almost destroied the anatomical features. Among these ten samples three are hinoki (*Chamaecyparis obtusa*, two are sugi (*Cryptomeria japonica*), two are kuri (*Castanea crenata*), and one of asunaro (*Thujopsis dolabrata*), shii (*Castanopsis cuspidata*), and pine (*Pinus* sp., Diploxylon). Hinoki were used for square pile, kuri and shii were round pile and sugi and pine were side board of moat.

S. HAYASHI, K. SHIMAJI and T. ITOH: **Anatomical Identification of Wooden Products Excavated from the Funao Nishi Site,** Sakai City Cultural Property Research Report, **6**, (2), 68 (1980). (in Japanese)

The funao nishi site is located on the senboku hill, and the Kamakura era (the Thirteenth century). The excavated seven wood products from a well and one drifted wood are tested. Among these samples three are hinoki (*Chamaecyparis obtusa*), three are sugi (*Cryptomeria japonica*), one is pine (*Pinus* sp., Diploxylon) and one is willow (*Salix* sp.). Stick-like wooden product were made from pine and round chip-box were made by hinoki and sugi. Drifted wood is identified to willow.

S. HAYASHI, K. SHIMAJI and T. ITOH: **Anatomical Identification of Wooden Products Excavated from the Shin-Kanaoka Saraike Site,** Sakai City Cultural Property Research Report, **6**, (3), 83 (1980). (in Japanese)

This site is located in north-east of Sakai city. The excavated three wooden samples are identified to sugi (*Cryptomeria japonica*). Two samples are prepared from bottom of chip-box and one is from chopping-board.

Y. YAJIMA, A. ENOKI, M.B. MAYFIELD and M.H. GOLD: **Vanillate Hydroxylase from the White Rot Basidiomycete Phanerochaete chrysosporium,** Arch. Microbiol., **123**, 319 (1979).

A soluble enzyme fraction from *Phanerochaete chrysosporium* catalyzed the oxidative decarboxylation of vanillic acid to methoxy-*p*-hydroquinone. The enzyme, partially purified by ammonium sulfate precipitation, required NADPH and molecular oxygen for activity. NADH was not effective. Optimal activity was displayed between pH 7.5–8.5. Neither EDTA, KCN, NaN_3, nor *o*-phenanthroline (5 mM) were inhibitory. The enzyme was inducible with maximal activity displayed after incubation of previously grown cells with 0.1% vanillate for 30 h.

E. MAEKAWA and T. KOSHIJIMA: **Wood Polysaccharides dissolved into the Liquor in the Process of Chlorite Delignification II. Changes in amount and composition of hemicellulose dissolved from Akamatsu (Pinus densiflora) wood meal,** Mokuzai Gakkaishi, **26**, 614 (1980).

In this paper, quantitative changes of the amount and composition of carbohydrate dissolved into liquor during chlorite delignification by the method of Wise were investigated.

Wood meals of heartwood, sapwood (16 years old) and juvenile wood (3 years old) of Akamatsu were delignified repeatedly under a constant condition. Polysaccharide fractions dissolved into liquor during chlorite delignification were recovered as precipitates by addition of ethanol and separated into water-soluble (P_s) and water-insoluble (P) fraction, respectively. The content and composition of carbohydrate in these fractions were determined by quantitative analysis with gas liquid chromatography after acid hydrolysis and conversion into alditol acetates. α-, β-, and γ-Cellulose in the final residues (holocelluloses) obtained from repeated delignification were determined according to the usual wood standard analytical method.

The results were summarized as follows:

1) Yields of the fractions precipitated with ethanol were the highest at the first or second stage of repetitive delignification, and decreased with progress of delignification.

2) The carbohydrate contents of P_s fractions were the lowest value at the first stage, and increased as delignification progresses. On the other hand, those of P fractions containing large amounts of non-carbohydrate portion were less than 1%.

3) It was shown that loss of hemicellulose in holocellulose was rather marked as a result of repetitive delignification, and that the average of 1.4–1.5% of carbohydrate moiety per one stage of delignification was lost through dissolution into chlorite liquor from the original wood meal.

4) The maximal amount of lignin determined from UV absorption at 280 nm

was observed at the early stage of delignification, corresponding to 40–45% of the fractions precipitated by addition of ethanol.

5) The amounts of galactose and arabinose residues were rich in the fractions obtained from liquor at the early stage of delignification described in (4), and these residues decreased as delignification progresses, while xylose residue showed a remarkable increase.

6) Variation of mannose and glucose residues was, as a whole, uniform, although a slight change could be observed at the early stage of delignification.

E. MAEKAWA and T. KOSHIJIMA: **Wood Polysaccharides dissolved into the Liquor in the Process of Chlorite Delignification III. Amounts of polysaccharide components dissolved into liquor at the different stages of delignification of Akamatsu wood meal,** Mokuzai Gakkaishi, **26**, 624 (1980).

Polysaccharide components dissolved into liquor at different stages of chlorite delignification for heartwood meal of Akamatsu were examined in relation to delignification ratio (%). The result revealed that loss of the carbohydrate moiety from the original wood meal was controlled during the first 60% of delignification ratio, and beyond the level of 60%, rapid loss of carbohydrate proceeded remarkably.

K. INABA, Y. IIZUKA and T. KOSHIJIMA: **Fractionation of Sulfite Waste Components Accelerate the Growing of Lentinus edodes Mycelium,** Mokuzai Gakkaishi, **26**, 482 (1980)

Fraction LVD and LSD, both of which was recovered by addition of ethanol from the lower molecular-weight components of sulfite solid waste, were further fractionated by using Phenyl Sepharose column to 5 fractions. For acceleration of growing of *Lentinus edodes* mycelium, F-1 eluted by water from the column showed excellent results as follows: 49 mg/10 ml mycelium yield by addition of 3% F-1 (LVD) as carbon source, and 40 mg/10 ml yield when 3% F-1 (LSD) was added. Without the addition of LVD or LSD fraction, the yield of mycelium was around 10 mg. Two F-1 fractions showed sedimentation constants 0.73S and 0.99S, and $[\alpha]_D^{28°}$ +7.4 and +4.1 for F-1 (LVD) and F-1 (LSD), respectively. The contents of lignin was 86%; reducing sugars ranged from 5.0–5.5%; and sulfur and calcium were 3–4% and 2.0–2.5%, respectively. Sugar sulfonate was most abundant in F-1 (LVD) and the amount was determined to be 2.38%. It was found that: the acceleration was predominant when the molecular weight of the fraction of the sulfite solid waste (e.g. F-1) was uniform; some of lignin and carbohydrate co-existed in a fraction; and a large part of the carbohydrate was sulfonated.

J. AZUMA, J. MORITA and T. KOMANO: **Process of Attachment of ØX174 Parental DNA to the Host Cell Membrane,** J. Biochem. **88**, 525 (1980).

The ØX174-DNA membrane complex was isolated from *Escherichia coli* infected with ØX174 *am*3 by isopycnic sucrose gradient centrifugation followed by zone electrophoresis. The ØX174 DNA-membrane complex banded at two positions, intermediate density membrane fraction and cytoplasmic membrane fraction, having buoyant densities of 1.195 and 1.150 g/ml, respectively. Immediately after infection with ØX147, replicating DNA was pulse-labeled and then the incorporated label was chased. The radioactivity initially recovered in the intermediate density membrane fraction migrated to the cytoplasmic membrane fraction. The DNAs from both complexes sedimented mainly at the position of parental replicative form I (RFI). The ØX174 DNA-membrane complex contained a specific membrane-bound protein having a molecular weight of 80,000 which is accumulated in the host DNA-membrane complex. These results suggest that when ØX174 DNA penetrated into cells in the early phase of infection, single-stranded circular DNA was converted to parental RFI at a wall/membrane adhesion region and migrated to the cytoplasmic membrane fraction, where the parental RF could serve as a template in the replication of progeny RF.

A. ENOKI, G.P. GOLDSBY and M. H. GOLD: **Metabolism of the Lignin Model Compounds Veratrylglycerol-β-guaiacyl Ether and 4-Ethoxy-3-methoxyphenylglycerol-β-guaiacyl Ether by Phanerochaete chrysosporium,** Arch. Microbiol., **125**, 227 (1980).

The white rot fungus *Phanerochaete chrysosporium* metabolized the lignin model compounds veratrylglycerol-β-guaiacyl ether I and 4-ethoxy-3-methoxy-phenylglycerol-β-guaiacyl ether V in stationary culture under an atmosphere of 100% oxygen and under nitrogen limiting conditions. 2-(o-methoxyphenoxy)-ethanol VII was identified as a product of the metabolism of both substrates. Veratryl alcohol and 4-ethoxy-3-methoxybenzyl alcohol IV were identified as metabolites of I and V respectively. Metabolites were identified after comparison with chemically synthesized standards by mass spectrometry. These results indicate the existence of an enzyme system capable of directly cleaving the etherated dimers I and V at the α, β bond. The additional identification of 2-(o-methoxyphenoxy)-1,3 propanediol IX as a metabolic product indicates that cleavage of the alkyl-phenyl bond of these dimers or their metabolities also occurs.

A. SATO: **Utilization of Wood Wastes and Residues in the Philippines —Destruction of Refractory Bricks—,** Wood Research Review (Mokuzai Kenkyu Shiryo) **14**, 1 (1979). (in Japanese)

The investigation for wood wastes and residues in the Philippines and analytical experiments about woods and barks from Mindanao Island (Philip.) were done by

the author. Much difference of ash contents from woods and barks was recognized experimentally due to species. The troubles on destruction of refractory bricks which are used as inner-wall of bark boilers are discussed with relation to the ash contents.

Some analytical data and several pictures from Eastern Mindanao Island are also shown.

F. NAKATSUBO and T. HIGUCHI: **Syntheses of Phenylcoumarans,** Mokuzai Gakkaishi, **25**, 735 (1979).

The first general synthetic method of phenylcoumarans was established starting from vanillin. The present synthetic method must be important not only in the fields of lignin chemistry but also extractives, *e.g.*, lignan.

F. NAKATSUBO and T. HIGUCHI: **Synthesis of Trimeric Lignin Model Compounds Composed of Phenylcoumaran and β-O-4 Structures,** Mokuzai Gakkaishi, **26**, 31 (1980).

A trilignol (8) composed of phenylcoumaran and β-O-4 structures was synthesized in high yields in a series of the synthetic studies of lignin model compounds. This synthetic method should be important for the studies of lignin reactions such as pulping, chemical utilization and biodegradation of lignin.

H. NAMBA, F. NAKATSUBO and T. HIGUCHI: **Synthesis of Trimeric Lignin Model Compound Composed of β-O-4 and β-1 Structures,** Mokuzai Gakkaishi, **26**, 426 (1980).

Trilignol (1), composed of β-O-4 and β-1 structures, major substructures in lignin, was synthesized in high yield, as part of a series of synthetic studies of trilignols containing the variously substituted aromatic rings occurring in gymnosperm and angiosperm lignins.

Y. KAMAYA, F. NAKATSUBO and T. HIGUCHI: **Synthesis of a Trimeric Lignin Model Compound Composed of β-O-4 and Syringaresinol Substructures,** Mokuzai Gakkaishi, **26**, 471 (1980).

As part of a series of studies on the synthesis of lignin model compounds, trilignol (10), composed of β-O-4 and syringaresinol substructures, was synthesized. This trimer represents major substructural components in hardwood lignin. An improved method for sinapylalcohol preparation was devised in connection with d, l-syringaresinol synthesis.

T. KATAYAMA, F. NAKATSUBO and T. HIGUCHI: **Initial Reactions in the Fungal Degradation of Guaiacylglycerol-β-Coniferyl Ether, a Lignin Substructure Model,** Arch. Microbiol., **126**, 127 (1980).

Fusarium solani M-13-1 was shake-cultured in a medium containing guaiacyl-

glycerol-β-coniferyl ether (I), a model compound representing the arylglycerol-β-aryl ether linkage in lignin, as sole carbon source. From the culture filtrate guaiacylglycerol-β-coniferyl aldehyde ether (II) and guaiacylglycerol-β-ferulic acid ether (III) were isolated as metabolic products. Incubation with (III) resulted in formation of guaiacylglycerol-β-vanillin ether (IV), which was further metabolized to guaiacylglycerol-β-vanillic acid ether (V). The results indicate that the cinnamyl alcohol group of (I) is initially oxidized to an aldehyde group, which is further oxidized to a carboxyl group, yielding (II) and (III). Compound (III) is converted to (IV) by the release of a C_2 fragment, and the aldehyde group of (IV) is further oxidized to a carboxyl group, giving (V). In the pathway from (I) to (V), neither oxidation of the benzylic secondary alcohol to ketone nor cleavage of the arylglycerol-β-aryl ether linkage was observed. The fungus was found to attack both *erythro* and *threo* form without distinction.

A. NOGUCHI, M. SHIMADA and T. HIGUCHI: **Studies on Lignin Biodegradation, I. Possible Role of Non-specific Oxidation of Lignin by Laccase,** Holzforschung, **34**, 86 (1980).

The significance of nonstereospecific oxidation of lignin catalyzed by laccase/O_2 was investigated in relation to the fungal degradation of lignin polymer. By use of specifically $^3H/^{14}C$-double labeled synthetic lignins (DHPs), it was shown that significant amounts of the ^3H-label were removed equally from that α- and β-positions of the side chain on laccase/O_2 treatment, whereas γ-^3H-label was not removed apparently. The ^3H labeled methoxyl groups of angiosperm-type lignin were found to be more labile on laccase treatments than those of gymnosperm type lignin.

T. HIGUCHI and F. NAKATSUBO: **Synthesis and Biodegradation of Oligolignols,** Kemia-Kemi, **9**, 481 (1980).

Lignin has no regularity, optical activity or crystallinity, and therefore the structure of lignin oligomers can not be determined by X-ray analysis; these compounds occur as the noncrystalline mixtures of the diastereomers. Nevertheless, in lignin chemistry, the structure of oligomers has not usually been proved by their synthesis, because, unfortunately, a general synthetic method for them has not been available.

We have recently developed synthetic methods for several oligolignols (dilignols, trilignols and tetralignols) which should be useful not only as authentic samples but also as model compounds in various lignin reactions such as pulping, chemical utilization and biodegradation of lignin. Here, these general synthetic methods and some biodegradative reactions of oligolignols which are major substructures in the lignin macromolecule are presented.

F. NAKATSUBO and T. HIGUCHI: **Synthesis of Trimeric Lignin Model Compound Composed of Phenylcoumaran and β-1 Structures,** Mokuzai Gakkaishi, **26**, 107 (1980).

A trilignol (5) composed of phenylcoumaran and β-1 structures, a main substructure compound in lignin, was synthesized in high yields in a series of the synthetic studies of lignin model compounds. This synthetic method should be important for the studies of lignin reactions such as pulping, chemical utilization and biodegradation of lignin.

S. IWAHARA, T. NISHIHIRA, T. JOMORI, M. KUWAHARA and T. HIGUCHI: **Enzymic Oxidation of α,β-Unsaturated Alcohols in the Side Chains of Lignin-related Aromatic Compounds,** J. Ferment. Technol., **58**, 183 (1980).

An enzyme which catalyzed oxidation of the α,β-unsaturated primary alcohol group in the side chain of dehydrodiconiferyl alcohol to the corresponding aldehyde was excreted into the culture media by several molds that degraded synthetic lignin-a dehydrogenation polymer of coniferyl alcohol and lignosulfonate. The enzyme produced by *Fusarium solani* M-13-1, partially purified by gel filtration, specifically oxidized α,β-unsaturated alcohols in the side chains of lignin-related aromatic compounds such as coniferyl alcohol, cinnamyl alcohol, dehydrodiconiferyl alcohol and guaiacylglycerol-β-coniferyl ether, but did not oxidize aromatic alcohols such as benzyl *o*-, *m*- and *p*-methoxybenzyl, and vanillyl alcohols or aliphatic alcohols such as methanol, ethanol, butanol. The reaction required one mole of oxygen to oxidize one mole of substrate and produced one mole of hydrogen peroxide. It is suggested that this enzyme also oxidizes α,β-unsaturated alcohol groups in the side chains of high molecular weight lignins.

H. SASAKI: **Properties of Wood-Based Materials,** (Lecture, Characteristics of Wood 6), J. Soc. Materials Science, Japan, **28**, (314), 1136 (1979). (in Japanese)

All wood-based materials including newly developed oriented boards were classified by a system consisting of the orientation order and the size of the constituents. In this classification, solid wood, glue-lam, LVL, oriented particleboard and oriented fiberboard are the materials of an identical category. Anisotropy of these materials was discussed.

T. MAKU and M. MASUDA: **Living Confort Characteristics of Wood Based Materials,** (Lecture, Characteristics of Wood 7), J. Soc. Materials Science, Japan, **28**, 1246 (1979). (in Japanese)

Living space which has a lot of wooden material gives us good feeling. In this lecture it was tried to make clear scientifically why wood is prefered to interior materials e.g. wall, floor, ceiling and furniture.

H. SASAKI: **Tendency of Research and Development of Wood-Based Materials,** Wood Research Review **14**, 27 (1979). (in Japanese)

Recent researches and developments in the field of wood-based materials in North America and Japan were reviewed comprehensively. Those works were assessed from the four points of view: conservation of forest resources, saving production energy, automation, and structural use of wood-based panels. Some new products were introduced.

S.P. TAKINO and H. SASAKI: **Properties of Sugi from the Thinning Operation for Structural Use,** Mokuzaikenkyushiryo (Wood Research Review), **14**, 99 (1979). (in Japanese)

Properties of Sugi from the thinning operation for structural use are descrived.

S. ISHIHARA, M. GOTODA, Z. W. NAM, T. MAKU, H. KANEDA and N. TAKESHITA: **Note on Wood-Plastic Composites by Ionizing Radiation. II. —Effects of Additives on Some Mechanical-and Physical Properties and Flame-Retardancy of the Wood-Polyvinylidene Chloride Composites—,** Wood Research Review **14**, 87 (1979).

Specimens of Buna (Fagus crenata BLUME) and Akamatsu (Pinus densiflora SIEB. et ZUCC.) were impregnated with vinylidene chloride monomer combined with some additives which were fire retardant synergistic agents for the vinylidene chloride, and exposed to the ^{60}Co source.

The wood-plastic composites were tested as to their MOR, MOE, shear strength, surface hardness, hygroscopicity, dimesional stabilities, and their flame-retardancy. The mechanical-and physical properties of the wood-plastic composites treated with vinylidene chloride combined with such additives as antimony trioxide, triarylphosphate, and acrylonitrile, and their mixtures respectively, were similar tendencies those of the wood-plastic composites treated with vinylidene chloride alone described in previous paper. The efficiencies of the flame retardancy and fire-extinguishment of the wood-plastic composites treated with vinylidene chloride monomer combined with antimony trioxide or triarylphosphate were greater than those of the wood-plastic composites treated with vinylidene chloride alone.

H. SASAKI, S. KATO and S. INOUE: **Properties of Plywood Box-Beams with Miter Corner Joints,** Wood Industry, Japan, **35**, (8), 26 (1980). (in Japanese)

Production technology and structural performance of plywood box-beams with the miter corner joints were tested in full scale, and the results were discussed. The conclusions are as follows:

1) The beams are strong enough for the structural use.
2) The design criterion of the beam is 6 kg/cm^2 shear stress at the reentrant

corner of the cross section.

3) Stabilities in water immersion were excellent in comparison with commercial glue-lams.

H. SASAKI: **Effective utilization of Forest resources and Research and Development of Wood-Based Materials,** Wood Industry, Japan, **35**, (12), 8 (1980). (in Japanese)

Establishment of the Ideal recycle of forest resources was proposed and the supply and demand of wood in Japan were forecasted.

Energy reguirement in wood industry, importance of the anisotropy in wood-based products, and application of natural resources to wood adhesives were discussed and assessed.

T. HAYASHI, H. SASAKI and M. MASUDA: **Fatigue Properties of Wood Butt Joints with Metal Plate Connectors,** Forest Products Journal, **30**, (2) 49 (1980).

Mechanical properties of wood butt joints with metal plate connectors have mainly been determined by static load tests. Tests to determine the fatigue properties of such joints subjected to cyclic loading (needed for determining safe design loads and for predicting the service life of the joints) have been scarce. Reversed and nonreversed cyclic loading tests were therefore made on butt-jointed wood members with pressed-in type metal plate connectors. A linear relationship between load levels and number of cycles to failure up to 5 million cycles and then to a definite fatigue limit existed. The fatigue limit lay around 20 to 25 percent of the static tensile strength for nonreversed loading and 17 to 20 percent for reversed loading. The failure mode of the joints varied with load level. The teeth were pulled out of the wood when tested at high load levels, while they were sheared off at the roots when tested at low load levels.

M. TAKAHASHI: **Wood Decay by Microfungi (An Outline),** Trans. mycol. Soc. Japan, **19**, 231 (1978). (in Japanese)

Characteristics of wood decay by microfungi was briefly reviewed. Formation of cavity and erosion as an attacking way of cell wall, and low attacking ability against softwoods were emphasized.

M. TAKAHASHI: **Staying at Swedish University of Agricultural Sciences,** Mokuzai Kogyo, **35** (1), 24 (1980). (in Japanese)

Swedish University of Agricultural Sciences (Sveriges lantbrucks-universitet, an abbreviation SLU) was established in 1977. The College of Forestry, the Agricultural College and the Veterinary College together constitute the University. The University comes under the auspices of the Ministry of Agriculture. The research programmes of the College of Forestry, the tendency of research on wood preservation in Sweden

and the condition of Swedish people were outlined.

K. TSUNODA and K. NISHIMOTO: **Shipworm Attack in the Sea Water Log Storage Area and its Prevention (2)—Life History and Rearing Techniques of the Shipworm,** Mokuzai Kogyo, **34** (12), 16 (1979). (in Japanese)

Life history of the shipworm from fertilization to initial penetration is briefly mentioned. Laboratory techniques to rear shipworms are outlined for the purpose of observing larval behavior, evaluating the effectiveness of chemicals on shipworm's activity, and so forth.

K. TSUNODA and K. NISHIMOTO: **Shipworm Attack in the Sea Water Log Storage Area and its Prevention (3)—Season of Settlement,** Mokuzai Kogyo, **35** (4), 24 (1980). (in Japanese)

In Japanese waters the season of settlement of shipworms lasts for 6–8 months from June in which water temperatures are above 18°C. Recent results on the season of settlement in the sea water log storage area in Fukui Pref. is described with discussing the factors (water temperature-, salinity-, and water depth-preference) influencing shipworm's activity.

K. TSUNODA and K. NISHIMOTO: **Shipworm Attack in the Sea Water Log Storage Area and its Prevention (4)—Growth Rates of the Shipworm and the Rates of Shipworm Attack on Wood,** Mokuzai Kogyo, **35** (7), 25 (1980). (in Japanese)

Mechanical boring movement of the shipworm is shown with a series of photographs of their action. *Teredo navalis*, one of the commonest teredine species in the world, grows up to 100 mm within 2–3 months, and some extend their body lengths over 200 mm in 5 months. As shipworms keep growing, wood in which they live naturally gets severer damage, e.g. over 5% cross-sectional area reduction in 2 month submergence in sea water.